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Measuring the impact of telecommunication services on rural and remote communities

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Abstract

The potential benefits that telecommunication services bring to rural and remote communities are generally perceived as beneficial though difficult to ascertain. This article reviews the rationale and elements for measuring the impact of telecommunication services on rural and remote communities, and proposes some concrete ways forward based on current practice.

Keywords: Evaluation; Telecommunication services; Rural; Remote; Community development; Canada; Smart communities

> One does not build bridges by counting the number of people who swim across the river (anonymous, cited in Sawhney, 2001).
>
> ...communication should be measured by the successful coordination of efforts (Peters, 1999).

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1. Introduction and context

The potential benefits that telecommunication services bring to rural and remote communities are generally perceived as beneficial though their actual impact is difficult to ascertain. Demonstrating causality is a challenging proposition in that many variables affect the relationship between technological investments and the subsequent changes that they contribute to in a community. This paper explores efforts at measuring impact with reference to an ongoing project in remote communities in Canada, where advanced telecommunication services are being introduced. The authors have been involved as partners with a project that seeks to demonstrate how information and communication technologies and services can improve the livelihoods of aboriginal groups in remote communities.

K-Net is an aboriginal network that is providing broadband connectivity to First Nations communities in the remote regions of northwestern Ontario, Canada. The network is formally known as the Kuh-ke-nah Network of SMART First Nations. Kuh-ke-nah is an Oji-Cree expression for "everybody" and that is the goal of this network—it is for everybody (Ramírez, et al., 2003).

The communities are part of Nishnawbe-Aski Nation (NAN), located in northern Ontario, across an area roughly the size of France. NAN includes a population of approximately 25,000. The majority of this population is aboriginal and lives in remote communities with 300–900 inhabitants. For many communities, the only year-round access into or out of their area is by small airplane, though most have winter road access for 5 or 6 weeks during the winter season.

2. Why is measuring important? A rationale

The setting is rural and remote communities that are characterized by low population densities and large geographic areas. In these places, the market often fails to respond to a weak or unproven demand for telecommunication services, particularly when policy and regulatory contexts do not highlight universal access. The telecommunication services refer to basic telephones or computers with Internet access in emerging market countries, broadband Internet access in developed countries, and computer-based applications of telecommunication services.

In the case of the expansion of telecommunication services to rural and remote areas the market generally responds with the minimum investments required to meet local demand or comply with regulators' requirements. A case in point is the 1999 ruling for High Cost Serving Areas by the Canadian Radio-television Telecommunications Commission (CRTC) that defined the "basic telephone service" that private carriers needed to comply with for the next 3 years, namely as single line touch-tone service with local access to the Internet (CRTC, 1999). This is the standard of service that any subscriber in Canada can expect to receive by 2003. In other words, a rural subscriber gets access to dialup when those living in most urban and small cities are already enjoying broadband services. This is indicative of a worldwide trend where rural and remote telecommunication infrastructure and services lag behind urban ones. It is also the reason why investments in telecommunication services in these areas tend to involve some sort of donor or governmental incentive programme. Such programmes are usually characterized as "universal access" programmes.

The provision of "universal access" to telecommunication services is an important objective of communication and economic development policy and legislation in many developed countries *and* emerging market countries. Even now in Africa, it is common for there to be fewer than one telephone per 100 people, compared to 10 lines per 100 people in Latin America and over 64 in the United States. There is a well-documented correlation between telecommunication access and national economic development.

Having tangible evidence about the benefits of telecommunication services appears to offer promise in several ways. As a planning tool, it can inform decisions to build infrastructure. As an evaluation tool, it can corroborate the benefits of an investment. Finally, as a process documentation tool it can provide lessons for improved replication of pilot experiences. In this paper, the authors show that these different benefits are of different relevance to customers in rural and remote communities and that there is merit in addressing measurement in a strategic and select manner. In other words, measurement is important in that it provides an information input to support three functions: planning, monitoring and evaluation, and learning (National Research Council, 1998).

There is another very important dimension to measurement that is best summarized in terms of "what you measure is what you get.[1] Too often, rural telecommunication programmes measure only technical dimensions such as teledensity. Programmes and policies focused on increasing teledensity have demonstrated a poor track record in responding to the economic and social development priorities of rural communities. Teledensity measures can lead toward "line-dumping" where operators and governments seek to meet teledensity targets regardless of the needs of specific locations, the commercial viability of service in those locations, and the needs of users in those locations. The notion of *effective use* has begun to emerge as an additional metric that goes beyond teledensity to address the extent to which people have access to the infrastructure and can put it to work in practical ways (Gurstein, 2003).

If the goal of rural telecommunication policies and programmes is, in fact, to improve social and economic development, then there is a need to consider and review processes for selecting goals, objectives and measurement targets.

The rationale for government involvement in rural telecommunication access responds to the perception that telecommunication services have a positive role to play in community and regional development. When private investors do not fulfill that role, others have to intervene and treat it—at least temporarily—as a public good. As a result, a number of arrangements and partnerships between private organizations and public agencies have evolved: they range from competitive tenders where the bidder with the lowest subsidy requirement wins the license to build and/or operate a rural phone system (the case of rural telephony in Eastern Nepal, Peru, Chile, and Uganda), all the way to direct investment and ownership by state agencies of fibre optic networks—as is the case of the Iowa Communications Network, USA (Sawhney, 2001).

Beyond capital investment, there are examples of successful partnerships that cover the operating costs of installed infrastructure, applications and services. This applies both at the level of public co-financing of local telecentres (Proenza, 2001) and at the level of fibre-optic networks where government agencies take on the role of anchor tenants (Sawhney, 2001), thus insuring that

[1]D. Barr, pers. comm.

those same networks are available to the private sector, non-governmental organizations and consumers.

There is evidence that the community and rural development potential of telecommunication services depends on much more than investments in infrastructure. Most often, human resource development and awareness building are essential ingredients. The digital divide is not only about physical access to phone lines and computers, it is also about becoming aware of the potential values of telecommunication services, having access to training on a range of computer and information-related skills, and to having an occupation where the relevant uses for the technology yield added value or savings (van Dijk, 1999; van Dijk, 2001; Gómez & Martínez, 2001).

Even basic awareness building and training on the operation of telephone sets can be critically important in rural areas of developing countries where many people have never used a telephone. In Uganda, MTN Publicom, a cellular-based payphone business, provides rural "caravans" combining music and entertainment with basic instruction on how phones operate and how they can be used to enhance family life and businesses.

The above introduction points at several significant dimensions that require attention: availability and access to the infrastructure, the services and applications, efforts to build awareness of the value of specific services, and the training required to make them fully accessible and relevant. Each of these dimensions involves partnerships among stakeholders, and whenever there are partnerships and collaborative arrangements involving public money, it becomes necessary to track and document the performance of the investment.

3. Who benefits from measurement and when?

Several stakeholder groups stand to benefit from information on the potential and actual benefits of telecommunication services: private investors, government agencies and donors, service providers (health, education, local government, libraries, economic development, NGOs), and the users themselves (Table 1).

Table 1
The benefits of having measurement or estimates for different decisions and stakeholders

Decisions stakeholders	Planning	Evaluating	Replicating
Private investors and venture capitalists	To project a return on an investment and secure financing	Verification of the return on an investment	Increasing the return, often based on consumer surplus (willingness to pay)
Government/donor	Justifying decisions to fund requests	Defending decisions	Describing benefits beyond the economic return
Services providers (the supply side)	Justifying requests for funding	Demonstrating impact (quality of service, cost savings)	Projecting future benefits
Users (the demand side)	Justifying request for funding Priming the pump	Appreciating value	Seeking more options

Since the decisions and the stakeholders involved differ, the type of measurement or estimates will need to be specific to their needs. At the same time, they need to be sufficiently relevant and consistent to support the agreements among them. In this paper the authors argue that stakeholder involvement is necessary to determine goals and relevant indicators, as a basis for measuring impact. Furthermore, it is argued that existing conceptual frameworks and indicator categorization tend to ignore the specific needs and conditions of rural and remote communities.

3.1. Conceptual frameworks and indicator categories

From the methodological side researchers are working with the legacy of methods that measure the impact of rural telephony. Some of the methods aim to estimate the rate of return of investments in rural telephony (INTELECON, 1995; Kayani & Dymond, 1997), while others rely on national level statistics to demonstrate a positive correlation between infrastructure investments and economic indicators (Cronin, McGovern, Miller, & Parker, 1995; Parker & Hudson, 1995; Dholakia & Harlam, 1994; Hardy, 1980; Gilling, 1975; Saunders, Warford, & Wellenius, 1994; Wellenius & others, 1993). Those methods and correlations are proven; yet while access to telephony remains a key economic and infrastructure dimension telecommunication services, their impact is far more complex. In fact, from the conceptual side, researchers and practitioners have yet to fully grasp the fact that telecommunication services contribute to multiple social, economic, and livelihood dimensions that are interrelated in complicated ways (Hillier, 2000). The acknowledgement that multiple variables intervene is reported even in the narrower field of adoption of information systems (Legris, Ingham, & Collerette, 2003). Moreover, the research literature tends to focus on urban dimensions or on national level statistics; there are relatively few publications that focus specifically on the rural development dimension (Richardson & Paisley, 1998; Ramírez, 2001), though the number is now growing (Fuentes-Bautista, 2001; Ramírez, 2003).[2]

In short, what is being measured is a wide range of indicators that are chosen by the specific interest of each party as they are perceived to be of relevance to the subject matter. Policy makers may be satisfied with standard indicators of teledensity to satisfy universal access policies; commercial carriers will need to know the rate of return on investment; residential users will be mainly interested in the price and quality of service; while agencies involved in health and education may need to document the cost savings brought about by the use of the technology. There are multiple players and multiple targets, and measurement needs to embrace this complexity.

There are several frameworks in the literature that organize the multiple dimensions and issues that are affected by telecommunication services. Some of the frameworks attempt to organize indicators into coherent categories.

Fig. 1 illustrates the major dimensions and services along four quadrants: service and product on one axis, and transport and content on the other. This is an important first step that depicts the different dimensions that any one product or service belongs to. However, it remains a conceptual "locator" of variables. The same authors move from this conceptual framework to mapping indicators using a "footprint" diagram (Fig. 2). This kind of diagram serves best as a means of

[2]See also: http://www.telecommons.com/reports.cfm?itemid = 213.

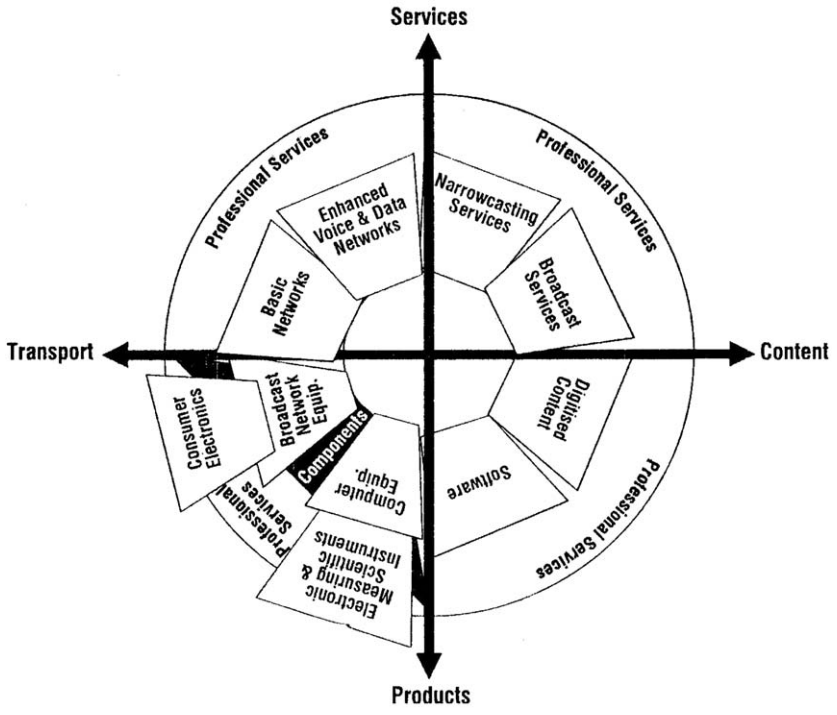

Fig. 1. The multiple dimensions of ICTs (Mansell & Wehn, 1998).

visualizing the relative country scores and drawing comparisons between them. Fig. 3 depicts an Australian effort that uses the same axes presented in Fig. 1 and organizes variables that are tracked by Australian government. Houghton (1999) developed this arrangement on the basis of logical relationships among the 16 groups of variables. He found, however, that the adoption of this tool within the government system was short lived (pers. comm.). Fig. 4 provides a summary of the groupings presented by the e-readiness guide of Harvard University (www.readinessguide.org). This is a web-based instrument that guides users through a range of variables, grouped under five major categories. The user learns about the relative e-readiness status of a given country.

The last three examples share the following features: they capture national level indicators, they provide a "status" report, they acknowledge multiple variables, and they do not capture a systemic analysis (though Houghton's includes a review of relationships among variables). None of them, however, focus specifically on rural and remote contexts, nor do they capture the complex interrelationships among the different variables. A summary of the relative contribution of each one of these methods is provided in Table 2.

4. A conceptual framework that captures multiple, interrelated dimensions

The debate surrounding the digital divide has invited a critical review of the dimensions that require attention, what Gómez and Martínez (2001) refer to as the social vision of the Internet.

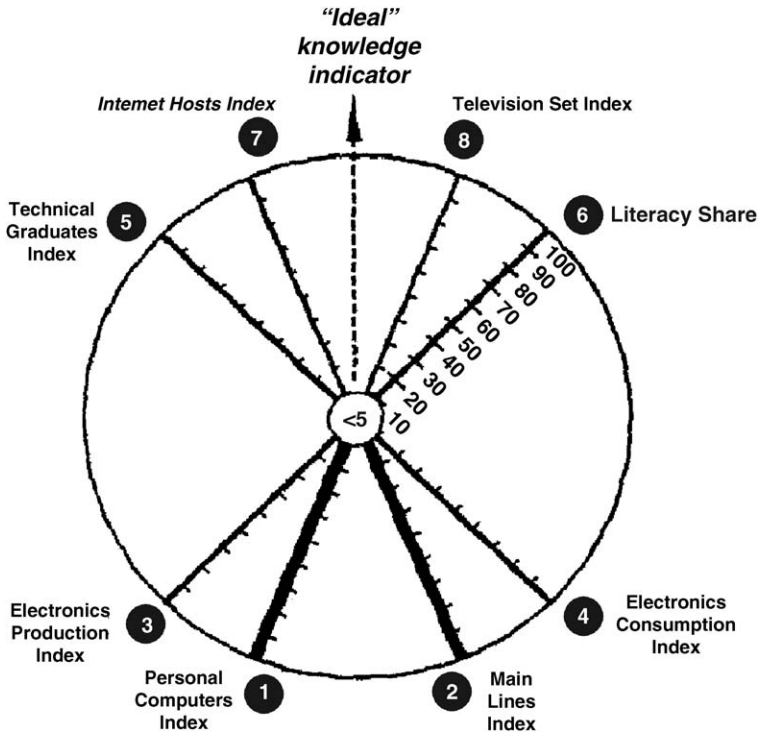

Fig. 2. Mapping indicators: a footprint analysis INEXSK INfrastructure, EXperience, Skills, Knowledge (Mansell & Wehn, 1998: p. 37).

They highlight several themes that require attention: going beyond connectivity and addressing the training needs and organizational behaviours that enable communities to harness the technology, promoting enabling environments such as expanding infrastructure to rural areas through universal access policies, and minimizing threats and risks to ensure human and organizational investments are sustainable. A sobering perspective is appearing:

> …the approach to ICTs must be information centred, integral to its environment, integrated with development objectives, intermediated, inteconnected, and indigenised (Heeks, 2002: p. 11).
>
> …[information and communication technologies] ICTs have many revolutionary implications, but in order to achieve their full potential benefits it is necessary to focus on user-oriented and cost-effective applications rather than on technology-driven applications (Mansell & Wehn, 1998: p. 95).

How to capture these requirements? There is a need for a new approach that acknowledges pluralist perspectives and the complexity of the many dimensions that are involved; in other words, a new epistemology (Ramírez, 2003). The authors' experience with community-based networks in rural and remote parts of Canada has led to an emphasis on four dimensions: the technology, the policy context, the community context, and most importantly the nature of the organizations that 'mediate' among these variables. This approach places emphasis on the

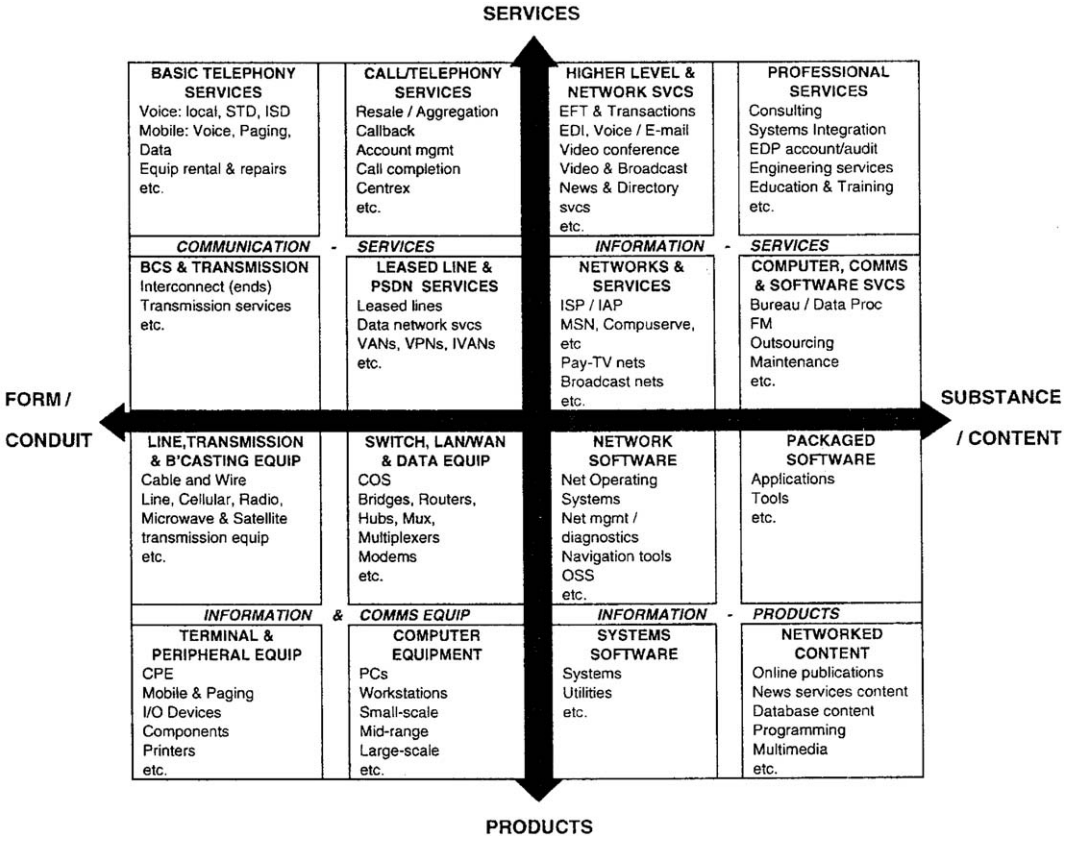

Fig. 3. The Australian technology map (Houghton, 1999: p. 692).

relationship among these dimensions and the evolution of the network (Fig. 5). This framework describes the dynamics behind the evolution of community-based networks. These dynamics refer to social and planning dimensions that have a foundation in community development.

The framework in Fig. 5 was developed on the basis of applied research that emphasizes the following interrelated dimensions: *Community* involvement in voicing needs through local "spaces and places" where different organizations can come together, and where they can vision their goals and develop monitoring and evaluation (M&E) tools to determine that they are reaching those goals. The *Policy* environment, both as a system of rules that influences the other dimensions, and as a continuum of programmes that become building blocks for organizational development at the rural community level. *Technology and Infrastructure*, namely, the applications that respond to organizational needs, and how these drive the need for hardware and bandwidth. Lastly, and at the centre: *organizational* issues, namely, how community networks emerge and provide a number of services, how they change through time, how they learn, and how coherent they are. The community networks that have been studied are best described as "mediating organizations" in that they mediate between the needs of the community, the policy environment, and the technology. This framework depicts a dynamic system that evolves, and in

INFRASTRUCTURE					
Information infrastructure	Internet availability	Internet affordability	Network speed	Hardware and software	Service and support
NETWORK LEARNING					
Schools access to ICTs		Enhancing education with ICTs		Developing the ICT workforce	
NETWORK SOCIETY					
People and organizations online	Locally relevant content	ICTs in everyday life	ICTs in the workplace		
NETWORK ECONOMY					
ICT employment opportunities	B2C electronic commerce	B2B electronic commerce	E-government		
NETWORK POLICY					
Telecom regulation		Telecom trade policy			

Fig. 4. The grouping of indicators in Harvard's E-readiness guide. Adapted from: Information Technologies Group (n.d.).

the authors' experience the most successful mediating organizations are the ones that evolve and learn fastest (Ramírez, 2001; Ramírez & Richardson, 2000).

The above conceptual framework provides a platform for measuring impact by drawing attention to four themes.

1. Community involvement in indicator selection: This is one area where telecommunication services research is embryonic. In other fields of study there are examples where stakeholders have negotiated the indicators and who tracks them (Besleme, Maser, & Silverstein, 1999; Guijt & Sidersky, 1996). The emphasis on the concerted action among stakeholders as a basis on which to gauge impact is beginning to be documented in the telecommunications literature (Taghioff, 2001; Chow, Ellis, & Walker, 2000; Durance & Pettigrew, 2001). In Canada the term "community engagement" is gaining importance as a fundamental step of developing "Smart" communities [a term that refers to communities that use information and communication technology] (http://smartcommunities.ic.gc.ca).

2. Organizational dimensions are also gaining attention; evaluating organizational capacities is an important area of research in other fields (Horton, 2001). Oftentimes, the capacity of the organizations to evolve and adapt to change has been highlighted as a critical element to capture in rural and remote ICT research (Ramírez, 2001; Moore, Ramírez, Coghlan, Oliphant, & Whiteford, 2001; Ramírez, Murray, Kora, & Richardson, 2000; Young, et al., 1997).

3. Individual skills and capacities are an important dimension to capture as they are central elements for accessibility (van Dijk, 2001) and this is an area where evaluation tools from adult education and community development have proven to be relevant (Ramírez et al., 2000).

4. Predictability: Information and communication technology has historically led to unexpected outcomes in terms of new telecommunications services. Bar et al. (2000) highlight this fact in their

Table 2
The relative contribution of existing methods to assess ICT uses and roles

No.	Title	Source	Contribution	Remark
1	Dimensions of technology practice and experience	Pacey (1999)	Expresses the multi-dimensional nature of technology	Multi-dimensionality
2	Creating the networks for an information society	Melody (1996)	Shows the infrastructure requirements before applications and services are possible	Infrastructure vs. applications and services
3	The components of demand and supply for user groups	Ramírez (2000); adapted from Melody (1996)	Definition of the dimensions of supply and differentiation between the demand by organizations vs. residential users	Supply and demand
4	The multiple dimensions of ICTs	Mansell and Wehn (1998)	Locates services along four quadrants on the basis of four axial themes: transport, products, content and services	Four axial themes: transport, products, content and services
5	The characteristics of the major periods of the Internet	Bar et al. (2000)	Characterizes the features of the Internet through its three major periods of evolution	Evolution through time
6	Mapping indicators: a footprint analysis	Mansell and Wehn (1998)	Multiple indicators across country-wide sectoral statistics	Food print notion: multiple indicators
7	Harvard's E-readiness guide	Information Technologies Group (n.d.)	Multiple indicators grouped by infrastructure, network learning, network society, network economy and network policy	Notion of readiness across five dimensions
8	The Australian technology map	Houghton (1999)	Sixteen quadrants locating standard industry indicators using similar axial themes to no. 4.	Comprehensive means of tracking and showing relationships among indicators groups
9	A framework for rural and remote information and communication technologies	Ramírez (2001b)	Describes the interplay between policy, technology, community and organizational variables in shaping community-based networks	Models the factors that shape a community network
10	Residential indicators of outputs	Ramírez (2000)	A review of common indicator groups from standard sources (emphasis on the Canadian context)	Suggests the need for contextual, goal-oriented approaches to make sense of the myriad of indicators

analysis of the third generation Internet, where the applications that will evolve are considered unpredictable. Urban planners acknowledge the difficulty in ascertaining ICT impact (Cohen, Salomon, & Nijkamp, 2002) and telecommunication planners acknowledge the limited predictability of impact (Bar et al., 2000; Fink & Kenny, 2003; Mitchell, 2003). How people use technology depends on them having a taste of its potential, on having a safe and comfortable setting where they can play with it, and then their creativity emerges (Ramírez, 2001). Some authors see mistakes as 'creative error'; man's inability to predict its creativity suggests it is a necessary—though unreliable—ingredient for innovation (Sawhney, 2001).

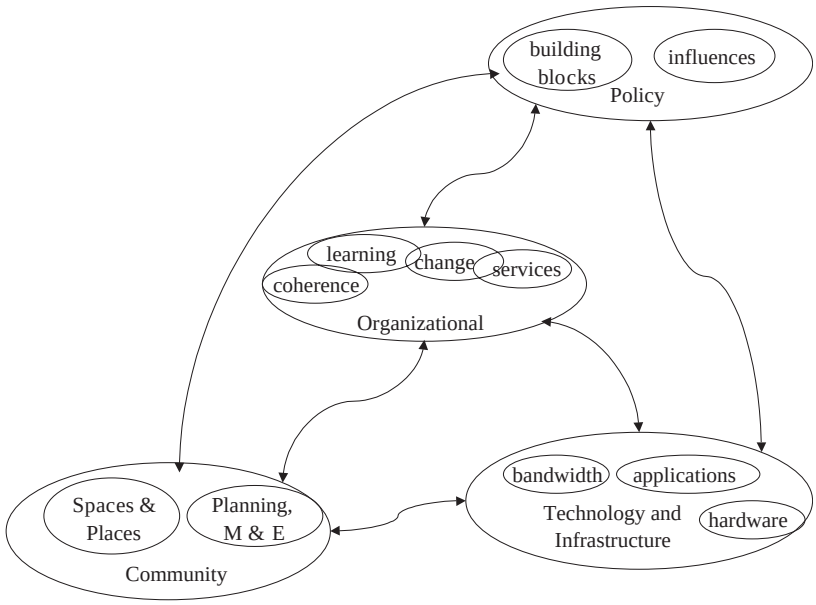

Fig. 5. A framework for rural and remote information and communication technologies (Ramírez, 2000).

We have now outlined four themes that require attention in agreeing how to measure impact:

1. Community involvement in indicator selection
2. Organizational dimensions
3. Individual skills and capacities
4. Limited predictability of the telecommunication services that emerge.

The first item calls for participatory approaches in the planning of telecommunication infrastructure and services. The second and third items remind us that organizational and individual issues of acceptance, integration, skill, and familiarity are of strategic importance. The fourth item signals the fact that the path is only partially mapped, and that adjustments to strategy and measurement are unavoidable.

5. Ways forward—a theoretical foundation

Systems thinking and participatory action research are two sets of approaches that provide practical tools to respond to the context described above. In this section, they are briefly described as building blocks for a way forward.

Systems thinking is holistic; it addresses overall patterns and relationships rather than reducing issues to smaller parts, which is the tendency of engineering approaches (Bennetts, Wood-Harper, & Mills, 2000). Systems thinking is useful as a tool for learning about complex situations and for interdisciplinary research (Ackoff, 1969). Since the late 1950s and early 1960s, systems thinking has also been applied to the analysis of organizations (Churchman, 1971; Emery & Trist, 1969;

Emery, 1969). What is relevant is the perspective that social and technological issues cannot be addressed in parallel; rather, they are to be analyzed jointly as a system and with the involvement of the stakeholders.

In a variation of systems thinking, Checkland and Scholes (1990) developed soft systems methodology, SSM. One key contribution of SSM is the notion that the key stakeholders involved in a system are owners of the problem or issue. In other words, those who are directly affected, 'own' the problem and should be involved in understanding and addressing it. SSM is therefore compatible with participatory action research approaches.

SSM and participatory action-research have been applied to the analysis and conceptualization of complex systems, both in organizational management and in natural resource management. In the authors' experience they are equally relevant to telecommunication services action-research.

> Soft systems methodology (SSM) originated from management science. It is an organized way to tackle real world 'messy' situations. A challenge arises when the problem is ill defined, complex, changing, messy and plagued with multiple interpretations (Checkland & Scholes, 1990). SSM takes a systems approach to explore problem situations where there is no fixed outcome (Moores & Gregory, 2000) and where multiple stakeholders' perspectives need to be accounted for.

There are a growing number of examples of SSM being applied to telecommunication services research and planning (Kidd & Leung, 2000; Bennetts, et al., 2000; Andrew & Petkov, 2000; Ramírez, 2001). SSM fits nicely into the ICT context where multiple parties are involved and have different perspectives, technical backgrounds, and terminologies; what communication writers refer to as different 'languages' (Peters, 1999; Jansen, 1989). In SSM, all of these stakeholders are seen as being 'co-owners of the problem', and are therefore in need of involvement in defining what it is that impact really means.

SSM emanates from systems theory where particular elements become immediately relevant: (1) the appreciation of multiple interrelated parts, (2) the notion of hierarchies, and (3) the notion of emerging properties. The first one is self-explanatory, but does pose a challenge to conventional research on linear, causal relationships. The second sheds light on the fact that any system has different levels, or nested hierarchies, that merit attention. In the telecommunications services field, this means we need to pay attention to at least three levels: individuals, their organizations or sectoral interests, and the communities they live in. The third element suggests that oftentimes, the outcomes of the system are not predictable as they in fact emerge from patterns of interaction that were not possible before. As mentioned earlier, in the Third Generation Internet age, there is growing evidence that the types of services that will emerge are difficult to predict (Bar et al., 2000).

In participatory-action research, making research both relevant and practical to the different groups and organizations involved in rural and remote telecommunication is a necessity. Action research is an established field in educational theory (Carr & Kemmis, 1983) and adult education (Kidd, 1973; Hall, Gillette, & Tandon, 1982). Adult education has been defined as a process that allows adults to become inner-directed, self-operated learners with an enlarged capacity for life and creativity (Kidd, 1973). The 'research' element in critical theory addresses the same goal: to transform the self-consciousness of individuals (Carr & Kemmis, 1983). Adult and popular education place emphasis on involvement by people in creating knowledge (Hall et al., 1982).

Creating knowledge is research—and people involvement is participation. Participation in appraising problems, in implementing projects and in evaluating their impact has become a central concern in community and rural development in the last three decades (Ramírez, 2000).

It is clearly apparent that there is growing interest in approaching impact evaluation on the basis of an approach where the users are involved in defining what it is they seek to accomplish (Menou & Potvin, 2000; Stoll, Menou, Camacho, & Khellady, 2002). Systems thinking, and in particular SSM, and participatory action research, provide theoretical and methodological tools that have already been developed in other fields and that promise to contribute to building approaches to measuring the multiple impacts that telecommunication services may contribute to rural and remote communities.

6. Experience to date: a case study

On the basis of the above theoretical foundation and in direct response to the four themes described earlier (community involvement in indicator selection; organizational dimensions; individual skills and capacities; limited predictability of the telecommunication services that emerge), the authors have developed an approach for measuring the impact of telecommunications services. It is worth emphasizing that the approach is still under construction: at the time of writing it is still at the implementation phase. The features of the approach are the following:

1. Tracking indicators at three levels: community-wide measures of accessibility, sectoral indicators, and discerning relative changes in individuals' skills and knowledge.
2. Sectoral action plans. Engagement of relevant stakeholders from the start of a project to envision where the community wants to go in terms of improved well-being and services, and putting telecommunications equipment and services to work in response to those visions This involves gathering indicators of results and of intermediary outputs from the stakeholders on a sector by sector basis (namely, health, education, local government and economic development).
3. Audio-visual testimonials: Using other qualitative tools, especially video to capture real-life stories about how people are harnessing the technology.

The approach emphasizes that monitoring and evaluation efforts are best addressed during the planning of telecommunication services, when relevant stakeholders can be consulted and engaged in brainstorming what they wish to do with the technology. The methodology addresses three hierarchies within a community context: a community-wide dimension, a sectoral or activity-based dimension, and a personal dimension. The concept of nested hierarchies (from systems thinking) is of relevance here in that the community is at the lower end of the region–nation–global hierarchy, and the evaluation addresses three hierarchies within the community level. The reference to three levels of hierarchy reflects a systems orientation for monitoring and evaluation.[3]

[3]This approach is not unique, for example, Statistics Canada began exploring a systems-oriented approach to assess the impact of science and technology some years back (Statistics Canada, 1998a, b).

Experience has also shown that a temporal dimension deserves attention. In the short run, accessibility indicators become evident (e.g. number of computers in the community); in the mid-term, service delivery is measurable (e.g. number of students enrolled in the Internet high school; number of telemedicine sessions via videoconferencing) and people are able to voice opinions about the changes on video; lastly, impact in terms of community goals or visions take time, often beyond the duration of a project intervention.

The context: K-Net Services, Northwestern Ontario, Canada. K-Net (K-Net.ca) is a regional information technology and content development organization that is working directly with five First Nations in the NAN of northern Ontario. K-Net supports and manages various local First Nation telecom initiatives across the region by delivering a variety of broadband services and developing electronic indigenous applications. Keewaytinook Okimakanak is a non-political Chiefs Council that advises and assists their member First Nations in the Sioux Lookout District of Northwestern Ontario. The Chiefs of the member First Nations that form the Board of Directors direct the organization. K-Net Services of Keewaytinook Okimakanak Northern Chief's Council develops and maintains the network. Approximately 2800 people live in Keewaytinook Okimakanak communities. Deer Lake is the largest community with a total population of 850. There are 314 people living in North Spirit Lake, 316 people living in Poplar Hill, 470 people live in the community of Fort Severn and 539 people reside in Keewaywin. The territory where K-Net is present is about 200,000 km^2 in size, with approximately 20,000 people from 23 First Nations north of Sioux Lookout (0.1 persons/km^2). Most of the communities are only accessible by small plane, and during a few weeks by winter roads (Ramírez, 2000).

The TeleCommons Development Group (TDG) is a consulting organization specializing in rural and remote telecommunications and both authors have been involved with this group. TDG has had extensive experience with research and planning interventions world wide, especially in the area of participatory planning and evaluation. The TDGand K-Net began applying the above approach in the five aboriginal communities directly supported by K-Net as of 1999–2000 (Keewaytinook Okimakanak, 2000).[4] K-Net will be implementing the Kuh-ke-nah network of Smart First Nations (smart.K-Net.ca) from 2000 to early 2004, as a national demonstration project under Industry Canada's Smart Communities Project.[5]

At the time of writing, the following actions have been implemented:

- Development, testing and distribution of a household survey covering all homes in the five communities (2000, 2001, 2002; the 2003 data was under review at the time of writing).
- Development, testing, distribution of an organizational and businesses survey in the five communities (2001, 2002; the 2003 data was under review at the time of writing).
- Analysis of the survey data and feedback at meetings in all of the five communities (2000, 2001 and 2002 data).
- Community engagement workshops in each of the five communities to consult on sectoral visions and gather indicators (2001–2002; with initial workshops to develop the approach in 1999).

[4]Readers are referred to (Ramírez, 2000, 2001; Richardson & Ramírez, 1999) for further background.

[5]For reference to the other Smart Demonstration Projects across Canada, and the overall programme, refer to http://smartcommunities.ic.gc.ca.

- Video training and interviews in late 2003 and early 2004.
- Preparation of a multi-media production with video clips and written case studies, 2004.[6]

The approach addresses three levels:

Level	Tool
Community-wide access to ICTs	Annual survey of residences and organizations
Sector-specific plans	Community engagement workshops to define goals and objectives in health, education, local government and business and how ICTs can augment those goals, complemented with video testimonials by people working in community agencies that are offering new services such as tele-health and internet high school
Individual skills and knowledge	Video testimonials where people express their views on the role and impact of the technology

Community-level access: This first dimension is addressed via a survey to track baseline indicators and provide a portrait of a community's level of access to information and communication technology. This element is labelled the "community telecommunications portrait" and it serves mainly to provide a baseline portrait of access. The indicators are selected from standard telecommunications indicators in the literature, both Canadian and international (Fig. 6).

The TDG and K-Net staff have already completed three rounds of house-to-house surveys and a fourth was implemented during the fall of 2003. By the end of the project 4 years of data would have been collected that will show the dramatic changes in communities that had no phone access before the end of the century and are now utilizing high-speed videoconferencing facilities.[7] Fig. 7 provides one example with cumulative data for one community over the first 3 years of the project. The most used Internet services are e-mail, the use for educational purposes and chat groups.

6.1. Sectoral action plans

The second element of the approach addresses sectoral plans developed during community engagement workshops (www.smart.K-Net.ca). Representatives from the major sectors of the community were invited for a 1-day planning session; these covered health, education and a combination of local government and economic development. The approach was labelled a results-based management framework. The focus is on how people want to use the technology and how they expect it will change their lives. While the design stems from logical framework analysis, in this case it is developed as part of a community engagement and planning process. This creates

[6] http://smart.knet.ca/kuhkenah_flash.html.

[7] A variation of the survey has been developed to document ICT access and use by businesses and agencies; it has been applied in other parts of Ontario and in Bolivia, South America.

Indicator	I TU (1999) Indicator names	HIFE, 1997 Indicator names	Census, 1996	UNDP Human (used for the HD INDEX)	Mansell & Wehn INDECES
Cable	I 965 C	CABLE TV			
Cellular Phone	I 271	CELPHONE		Mobile cellular telephone subscribers per 100 people	
Fax machines		Fa		x machines per 100 people	
Home Computer	I 422	COMP		Personal computers per 100 people	Personal computers per capita
Home Computer with modem	I 4133 Estimated modems in use	COMPWMOD			
Access to make / receive emergency call	EMERGC	ALL			
Use of internet	I 4221 (equivalent)	INTERNET		Internet users per 100,000 people	
Number of Colour TV sets	I 965	NCTVS			
Number of Telephone numbers	NF	ONNUMB			
Number of Telephones	I 91 (main lines/100 inhabitants "teledensity)	NPHONE	698 NTELPHON (Ag.Census 1996)	Main telephone lines per 100 people	Main Telephone lines per capita
Number of radios in HH	I 955	NRADIOS		Radios per 1,000 people	
Number of TV sets	I 965	NTVS		Televisions per 100 people	Number of TS sets per 100 population
Number of persons in household (HH)	I 61 POP I 62 HHs	PERINHH	Ave. no. of persons in married or common-law families		
Number of households (HH)			Number of private occupied dwellings		

Fig. 6. Residential indicators of outputs (Ramírez, 2000).

a context in which stakeholders are invited to identify relevant indicators. Its major contribution is the definition of a logical sequence of activities or outputs, outcomes and results.

The tools that are used come from participatory action research work and involve hands-on activities to visualize complex situations and focus on visions of a desirable future (Lightfoot et al., 2001). Participants were invited to define where they wanted to go with their services, what programmes are in place to achieve those goals, what telecommunications technologies and services are needed to enhance the programmes, and what indicators should be used to track impact.

For example, in one community the health sector team developed a list of results and linked these to the programmes that could help achieve the results. They provided a number of indicators to verify that the results had been achieved as well as others to verify that the programmes had

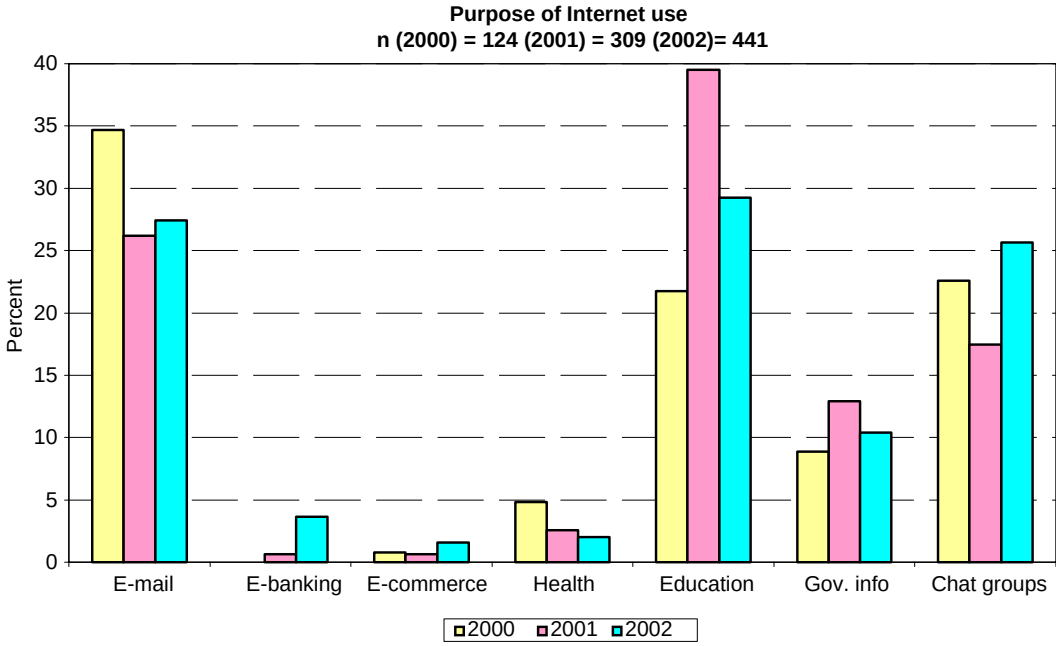

Fig. 7. The most used Internet services in Keewaywin First Nation, Ontario, between 2000 and 2002 (TeleCommons Development Group, 2002).

been implemented. The telecommunication technologies that could enhance those programmes were included between brackets.

Results	Indicators of results	Programmes	Indicators of programme impact
High esteem	Less violence, suicide rate drops, less vandalism; people involved in more positive activities, people working to keep their land clean; sense of pride	Social activities (computer club), mental health fitness programme	More community involvement in various programmes, i.e. fitness programmes, guitar lessons
Stress management	Less violence, better overall health, better quality of work	Guitar lessons, therapy, organization and coordination (list serve), fitness programme, leisure and recreation	More community involvement in various programmes, i.e. fitness programmes, guitar lessons
Healthy foods	Better nutrition, more traditional foods, class room visits, more healthy foods in store	Elder support (video conferencing), healthy babies, homecare, nutrition	

Health Sector	Band administration (local government office	Education Sector	Economic development
More people involved in the diabetic programs	No deficit	First nations businesses with outside partners	Parents and community talking to children in native language
More moms that are pregnant are aware of the effects of drugs, smoke, and alcohol abuse.	Improved staff relations	Expanded services and opportunities	Number of WAHSA students who have completed the program
Better nutrition	Number of video conferences	More jobs	More elders accepting technology
More traditional foods		New businesses	Adults enrolled in school
More community involvement in various programs, i.e. fitness programs, guitar lessons	Monthly budget meetings	Reduced welfare dependency	Getting computers for special needs
Better overall health		Better community environment	Individual Web sites
Better quality of work			School Web site
Fitness program		Business plans Proposals	
Social activities		Better maintenance for existing road	Using syllabics keyboards
Home care		Veggie garden	Training sessions at E-centre
Hygiene awareness		Better water and sewer	More people using on-line training
Housing awareness		Better houses	Number of students in grade 4 – 8
Better maintained homes		More equipment that works	Number of career days
Dentist and eye doctor			
Referral clerk			
Workshops and training			
More patients treated in community			
Better awareness of diabetes			

Fig. 8. Summary of indicators of results provided by the community of Keewaywin, Northwestern Ontario, Canada (TeleCommons Development Group, 2002).

It is worthy underlining that this process is not comprehensive, as the participants did not have experience with logical frameworks and planning. However, the process constitutes an important capacity building event to help people plan their development while harnessing the information and communication technologies. These participatory planning events are often not integrated into telecommunication planning in remote communities.

Fig. 8 provides a sample of the types of indicators that the community members contributed. The telecommunication services are to contribute towards the accomplishment of these goals, and the indicators reflect how the community describes the benefits.

The third element refers to people's skills and knowledge changes, something that is best captured in their own terms. The authors provided tools based on methods of adult education where people design their own learning objectives (Knowles, 1975). The tool was tested in the context of an evaluation of a rural library project in southern Canada. However, in the K-Net demonstration project, these tools have had limited acceptance. However, the authors have come to realize that people harness technology and make it work for them in unpredictable ways. The surveys will never capture that richness. Real life stories of how telecommunication services can bring about new opportunities and perspectives are best captured with audio-visual media. Video technology lends itself to involving young people in using the tools in a creative manner.

Testimonial video-clips capture personal perspectives about how the technology is changing livelihoods today. They introduce a tool to gauge current personal and organizational experiences. Video-clips and oral histories are already a part of the K-Net.ca website (see: www.legends.K-Net.on.ca) and are now also part of a multi-media production that includes five case studies (Ramírez, Aitkin, Jamieson, & Richardson, 2004). The importance of narrative as an evaluation tool becomes particularly relevant in a culture that has a strong oral tradition. Digital video has the added advantage of the ease of computer-based editing so that in the very near future, productions can be done by community members themselves (Ferreira, Ramírez, and Walmark (2004); Ferreira, Walmark, Kenny, and Ramírez (2004a)).

7. Conclusion

This article describes an approach for measuring impact and makes reference to some practical community engagement and monitoring work that is in progress. This work will yield time-series data that has thus far not been available in Canada. A number of elements require further attention. If a telecommunication investment demonstrates that a service can be delivered for a fraction of a price, one can only wonder how long it will take until the evidence is used to justify a cut in funding.

> It has been demonstrated that the cost of delivering this [telemedicine] service as an ongoing program, with 2–3 clients drawn from all of the Keewaytinook Oldmakanak First Nations Communities being seen during weekly 1.5-hour teleconferencing sessions, averaging 4 per month over 12 months, is estimated to be as much as $985 per client-session (and potentially, even less). This estimate is significantly less than the overall cost of delivering this service by flying clients out to the regional First Nations counseling centre in Sioux Lookout, estimated to be $2,716 per client-session in this study (Centre for Health Services and Policy Research, 2002: p. 49).

It is important to mention that in many cases the savings are being made by the external funding agencies. The extent to which these savings will be translated into improved and continued support to the communities remains to be seen.

Another limiting factor is the cost of tracking indicators: who is able and willing to spend the funds required for what is essentially a monitoring and evaluation activity? Who actually stands to gain from tracking indicators? In Canada, governmental incentive programmes are increasingly emphasizing the impact assessment dimension; and this becomes a requirement for project implementers and grant providers. However, the procedures for measuring impact assessment thus far remain undefined, which in itself may prove to be an opportunity for creativity and innovation.

This measurement approach is associated with a demonstration project of national stature, hence it has significant policy implications. The context of the remote aboriginal communities is drastically different from that of rural Canada; what emerges from this project will shape future programmes for the north. The low population density of remote communities means that there is at best a weak business case for the infrastructure in terms of revenue from the user base. However, there may be substantial savings for the agencies that provide the services. At the

community level, there are substantial human and social benefits that can translate into savings in other remedial programmes: keeping children in school longer may mean young people with higher self-esteem and fewer cases of teenage drug abuse. The recent case studies and video reports on the progress achieved with the K-Net demonstration project point towards the need to address measurement through broader lenses, including the sustainable livelihoods framework.[8]

The approach described in this paper is new in terms of how it combines quantitative tools, participatory planning using conventional tools, and video testimonials. The authors feel that this combination of methods has the potential to capture the impact at its different levels, and through the multiple perspectives of the stakeholders involved.

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[8]For an example, see the Economic development case study under http://smart.knet.ca/kuhkenah_flash.html.

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